WHAT IS CLAIMED IS:

1. An apparatus for mixing a first fluid stream and a second fluid stream, the apparatus comprising:

   a) a first supply conduit having a first supply conduit receiving end for receiving the first fluid stream and having a first supply conduit discharge end opposite the first supply conduit receiving end;

   b) a second supply conduit having a second supply conduit receiving end for receiving the second fluid stream and having a second supply conduit discharge end opposite the second supply conduit receiving end;

   c) a mixing chamber in fluid communication with the first and second supply conduits at first and second supply conduit discharge ends, where one of the first or second supply conduit discharge ends leads substantially tangentially into the mixing chamber and the other of the first or second supply conduit discharge ends leads substantially radially into the mixing chamber; and

   d) a mixing chamber outlet for discharging a mixed stream of the first and second fluid streams from the mixing chamber, the mixing chamber outlet in fluid communication with the central region of the mixing chamber and where the mixing chamber has a outlet characteristic length in a plane of the mixing chamber outlet and an inlet characteristic length in a plane of the mixing chamber inlets, and the outlet characteristic length is less than or equal to the inlet characteristic length.

2. The apparatus of claim 1 where the mixing chamber is substantially cylindrical in shape, where the outlet characteristic length is the height and the inlet characteristic length is the diameter.

3. The apparatus of claim 2 where the mixing chamber has a substantially circular cross section in a substantially horizontal plane from which the mixing chamber outlet leads substantially perpendicularly.

4. The apparatus of claim 2 where the mixing chamber outlet conduit has a circular cross section and the ratio of the diameter of the mixing chamber to that of the mixing chamber outlet is greater than about 5.

5. The apparatus of claim 1 further comprising:

a) a plurality of first fluid distribution conduits for distributing the first fluid stream;

b) a plurality of second fluid distribution conduits for distributing the second fluid stream; and

c) a plurality of supply conduits, each having a receiving end and a discharge end, the receiving ends in alternating fluid communication with the first and second fluid distribution conduits and the discharge ends in fluid communication with the mixing chamber, where the discharge ends lead alternately substantially tangentially and substantially radially into the mixing chamber.

6. The apparatus of claim 1 where at least one of the first or second supply conduits narrows in the direction from the supply conduit receiving end to the supply conduit discharge end.

7. The apparatus of claim 1 where the ratio of the length to the width, at their discharge ends, of the first and second supply conduits is from about 1 to about 30.

8. The apparatus of claim 1 further comprising:

a) a plurality of second fluid distribution conduits for distributing the second fluid stream;

b) a plurality of third fluid distribution conduits for distributing a third fluid stream; and

c) a manifold having an inlet and an outlet, the manifold inlet in fluid communication with the second and third distribution conduits arranged in a

repeating sequence, and the manifold outlet in fluid communication with the second supply conduit receiving end.

9. The apparatus of claim 8 where the manifold outlet has a curved surface.

10. The apparatus of claim 8 where the ratio of the sum of the cross sectional areas of the second and third distribution conduits to the cross sectional area of the second supply conduit receiving end is from about 1.5 to about 500.

11. A layered assembly for mixing at least two fluids, the assembly comprising:

a) a substantially planar cover layer having external and internal faces and defining first and second feed channels for receiving first and second fluids into the assembly, the first and second feed channels extending from the external surface to the internal surface to form first and second inlet ports; and

b) a substantially planar mixing layer having an upper and a lower face, the mixing layer upper face sealingly disposed on the cover layer internal face to define:

i) a first supply channel having a first supply channel receiving end in fluid communication with the first feed channel and a first supply channel discharge end opposite the first supply channel receiving end;

ii) a second supply channel having a second supply channel receiving end in fluid communication with the second feed channel and a second supply channel discharge end opposite the second supply channel receiving end;

iii) a mixing chamber in fluid communication with the first and second supply channel discharge ends, where one of the first or second supply channel discharge ends leads substantially tangentially into the mixing chamber and the other of the first or second supply channel discharge ends leads substantially radially into the mixing chamber, and where the mixing chamber has an inlet characteristic length in an inlet plane substantially

parallel to the missing chamber inlets and an outlet characteristic length in an outlet plane substantially perpendicular to the inlet plane; and

iv) a mixing chamber outlet channel in fluid communication with the mixing chamber for discharging a mixed stream of the first and second fluids from the mixing chamber.

12. The layered assembly of claim 11 where the cover layer and mixing layer each comprise one or more plates in a fluid-tight stacked arrangement.

13. The layered assembly of claim 12 where the plates are of an inert material selected from the group consisting of polymers, metals, alloys, glass, quartz, ceramic, and semiconductor materials.

14. The layered assembly of claim 12 where the plates have a thickness from about 10 μm to about 5 mm.

15. The layered assembly of claim 11 where mixing chamber outlet is in fluid communication with the central region of the mixing chamber.

16. The layered assembly of claim 11 where the mixing chamber outlet extends substantially perpendicularly from the mixer plate to the mixing layer lower face to form an outlet port for discharging a mixed stream of the first and second fluids from the assembly.

17. The layered assembly of claim 11 where the mixing chamber outlet extends substantially perpendicularly from the mixer plate to the cover layer external face to form an outlet port for discharging a mixed stream of the first and second fluids from the assembly.

18. The layered assembly of claim 11 where the mixing chamber is substantially cylindrical in shape.

19. The layered assembly of claim 11 where the ratio of the diameter of the mixing chamber to the width of each of the first and second supply channel discharge ends is greater than about 10.

20. The layered assembly of claim 11 where the mixing chamber is in fluid communication with a plurality of supply channels, each having a receiving end and a discharge end and the supply channel discharge ends lead alternately substantially tangentially and substantially radially into the mixing chamber, the layered assembly further comprising a substantially planar distribution layer having an upper face and a lower face, the distribution layer upper face sealingly disposed on the cover layer internal face and the distribution layer lower face sealingly disposed on the mixing layer upper face, the distribution layer interposed between the cover layer and the mixing layer to define:

    a) a plurality of first distribution ports, each in fluid communication at one end with a first fluid distributing structure and separately in fluid communication at the opposite end with alternating receiving ends of the fluid supply channels; and

    b) a plurality of second distribution ports, each in fluid communication at one end with a second fluid distributing structure and separately in fluid communication at the opposite end with alternating receiving ends of the fluid supply channels not in fluid communication with the first distribution ports, where the first fluid distributing structure is in fluid communication with the first feed channel, the second fluid distributing structure is in fluid communication with the second feed channel, and the mixing layer upper face is sealingly disposed on the distribution layer lower face to define the supply channels.

21. The layered assembly of claim 11 where the cover layer further defines a third feed channel for receiving a third fluid into the assembly, the third feed channel extending from the cover layer external surface to the cover layer internal surface

to form a third inlet port, the layered assembly further comprising a substantially planar distribution layer having an upper face and a lower face, the distribution layer upper face sealingly disposed on the cover layer internal face and the distribution layer lower face sealingly disposed on the mixing layer upper face, the distribution layer interposed between the cover layer and the mixing layer to define:

a) a plurality of second distribution ports, each having a second distribution port inlet end in fluid communication with a second fluid distributing structure and having a second distribution port outlet end; and

b) a plurality of third distribution ports, each having a third distribution port inlet end in fluid communication with a third fluid distributing structure and having a third distribution port outlet end, where the second fluid distributing structure is in fluid communication with the second feed channel, the third fluid distributing structure is in fluid communication with the third feed channel, and the mixing layer upper face is sealingly disposed on the distribution layer lower face to define a focusing chamber having an inlet and an outlet, the focusing chamber inlet in fluid communication with the second and third distribution port outlet ends arranged in a repeating sequence and the focusing chamber outlet in fluid communication with the second supply channel receiving end.

22. The layered assembly of claim 21 where the focusing chamber outlet defines curved surface.

23. The layered assembly of claim 21 where the ratio of the sum of the cross sectional areas of the second and third distribution port outlet ends to the cross sectional area of the second supply channel receiving end is from about 1.5 to about 500.